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Date 8/19/48

File

Subject Oak Ridge National Laboratory

Liquid Waste Disposal

Those Eligible To Read The Attached

By C. N. Rucker

Copy # 8

E. J. Witkowski

To F. H. Belcher

Before reading this document, sign and date below:

EJW 8/23

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Dovie Patterson

For: N. T. Bray, Supervisor
Laboratory Records Dept.
ORNL

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Technical Information Officer
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Date

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OAK RIDGE NATIONAL LABORATORY

DIVISION OF
CARBIDE AND CARBON CHEMICALS CORPORATION

UCC

POST OFFICE BOX P
OAK RIDGE, TENNESSEE

297

August 19, 1948

U. S. Atomic Energy Commission
Oak Ridge Laboratory Division
Post Office Box E
Oak Ridge, Tennessee

Subject: Oak Ridge National Laboratory Liquid Waste Disposal

Attention: Mr. F. H. Belcher

Reference: Your letter of August 5, 1948.

Gentlemen:

Attached is a report on the present liquid waste disposal system at Oak Ridge National Laboratory as requested in the reference letter. This report was prepared by the supervision of the Operations Division with the cooperation of personnel from the Health Physics Division. It is our understanding that Mr. J. H. Hayner, Division of Engineering, Washington, and the Atomic Energy Commission committee on waste disposal will be at the Laboratory during the week of August 23, 1948.

Very truly yours,

OAK RIDGE NATIONAL LABORATORY

C. N. Rucker
Executive Director

LBEmlet:wp

1-4. F. H. Belcher
5. C. E. Center
6. K. Z. Morgan
7. J. C. Stewart
8. E. J. Witkowski
9. C. D. Cagle (LSS)
10. L. B. Emlet
11-12. C. N. Rucker

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August 19, 1948

LIQUID WASTE DISPOSAL SYSTEM

at

Oak Ridge National Laboratory

SUMMARY

This report is divided into two main sections. The first is a general review of the facilities available for handling liquid waste solutions with brief statements of mud and water contamination in White Oak Creek and the Clinch River. The second part includes a flow chart and a more detailed description of the handling of liquid waste solutions.

A. GENERAL

The liquid waste disposal system, commonly known as the Tank Farm Area, is divided into three sections, as follows:

1. The North Farm - consisting of two, 4400-gallon, and two, 40,000-gallon-Gunite tanks.

2. The South Farm - consisting of six, 170,000-gallon-Gunite tanks; one, 1300-gallon-Gunite tank connected to an 800-gallon, stainless steel tank.

3. Settling Basin Area - consisting of a large earthen-diked pond of 1,600,000-gallon capacity and a smaller, 32,000-gallon Retention Basin. Two other ponds are provided for emergency use only.

All of the Gunite tanks are of similar construction regardless of size. The tanks are constructed of reinforced concrete, five inches thick, with dome-shaped tops. The inside wall is painted with a water-proofing compound. Approximately six feet of earth is used as shielding on top of each of the tanks. The tanks are set on a concrete saucer four feet larger in diameter than the tank. The saucer is filled with crushed rock to the top of the side wall of the tank and thus provides a French drain which is piped to a drywell. The drywells of all tanks drain to the Retention Pond in the Settling Basin Area. The Retention basin is sampled at four-hour intervals. Any increase in the activity dictates an investigation of the individual drywells. To the best of our knowledge, the tank walls are intact.

The Settling Basin is a dredged pond about 200 feet square and six feet deep. The waste waters enter the pond through five, eight-inch lines to a weir box which spans the north side of the pond.

The water is discharged through a similiar weir to White Oak Creek. Between the inlet and exit weir boxes are a series of floating surface baffles to insure effective mixing and to prevent algae growth from drifting into the exit weir. The Retention Pond is a dredged basin about twenty-five feet square and two feet deep. It is used merely as a hold-up basin.

In general, three types of wastes are handled in the Tank Farm Area:

1. Chemical waste solutions containing varying amounts of radioactive salts and particles. These waste solutions originate in the Chemistry labs, the processing plants, and the Pile Building. A flow of about 430,000 gallons a day with an average activity of approximately one hundred beta counts/min/cc is piped directly to the Settling Basin for disposal in White Oak Creek. A smaller volume (7,000 gallons/day) with activities in excess of 25,000 beta counts/min/cc is collected in the Gunite tanks and allowed to decay for thirty to sixty days before being disposed of through the Settling Basin to White Oak Creek.

2. Metal waste solutions containing uranium, plutonium, and fission products are received at the rate of 5,300 gallons/month for storage in the Gunite tanks. To conserve tank storage space these solutions are treated periodically with a fifty-percent caustic solution to precipitate the Source and Fissionable materials. The supernatant is then decanted to the chemical waste system for disposal in White Oak Creek. The precipitation treatment reduces the volume by a factor of two. At the present time approximately 132,460 kg of uranium are stored in a volume of 540,000 gallons.

3. Miscellaneous waste solutions from other AEC installations are received in drums and specially-designed, lead-shielded pots. These solutions vary in composition. Some contain Source and Fissionable materials which are handled in the metal waste system. Others are aqueous fission product solutions which are handled with the chemical wastes. Occasionally solvent solutions are received in which case the solvent is removed by steam distillation and the activity is transferred to the tanks.

White Oak Creek is a small stream running along the south boundry of the Settling Basin. Its flow varies from 0.7 cu. ft. to 24.5 cu. ft./second, depending upon the rainfall. About two and a half miles below the Settling Basin is a dam to retard the flow and allow further

settling of radioactive materials. The White Oak Creek empties into the Clinch River about a half mile downstream from the dam.

The amount of activity discharged from the Settling Basin to the White Oak Creek is limited to five curies/day. This limit is controlled by the flow rate and activity discharged from the Gunite chemical waste tanks.

Mud samples taken in the upper part of the lake formed by the dam on White Oak Creek range from ninety to 25,000 counts/min/gm of mud. The highest detected in the mud of the Clinch River below the mouth of the White Oak Creek showed 116 counts/min/gm of mud. Water flowing over the White Oak Creek dam averages ten counts/min/cc, while just above the K-25 Plant side on the Clinch River the water measures 1.6 counts/min/cc.

B. OPERATION

1. Chemical Waste Solutions:

The following facilities of the Tank Farm Area are used in handling the chemical waste solutions:

Tank No.	Capacity	Location
W-1	4,400-Gallon-Gunite	North Farm
W-2	4,400-Gallon-Gunite	North Farm
W-5	170,000-Gallon-Gunite	South Farm
W-6	170,000-Gallon-Gunite	South Farm
W-11	1,300-Gallon-Gunite	South Farm
W-12	800-Gallon-Stainless Steel	South Farm
Settling Basin	1,600,000 Gallons	Settling Basin Area
Retention Pond	32,000 Gallons	Settling Basin Area.

For ease in handling the chemical waste solutions are divided into two groups:

a. Large volume (average of 430,000 gal/day) and low activity wastes (average of 100 beta counts/min/cc) originate from the floor drains, laboratory sinks, canal overflow, and the operations in the Rolling Mill and Fan House. These waste solutions are for the most part piped directly to the Settling Basin.

b. Small volume (average of about 7,000 gal/day) and high activity (in excess of 25,000 counts/min/cc) wastes originate in the various processing buildings, fan seals, stack drains, laboratory hot sinks, or as shipments from other AEC installations. These wastes enter either the catch tanks (W-1 and

W-2) or the diversion tank (W-12). The solutions collected in the catch tanks (W-1 and W-2) are neutralized with sodium carbonate and sampled. If the activity is less than 25,000 counts/min/cc, the solution is disposed of to the Settling Basin. If the activity is in excess of this limit, the solution is collected in one of the hold-up tanks (W-5 or W-6). The diversion tank (W-12) is equipped with an automatic steam jet which transfers the waste solution to one of the hold-up tanks (W-5 or W-6).

The collected solutions in the hold-up tanks (W-5 and W-6) are maintained alkaline by sodium carbonate. Under present conditions all solutions in the hold-up tanks are allowed to decay for approximately one month before disposing of to the Settling Basin. The alkaline condition of the solution in the hold-up tanks causes some precipitation of the various activities while additional decontamination of the waste solution is realized, due to the carrier action of foreign matter, as the supernatant is passed through the Settling Basin.

2. Metal Waste Solutions:

The uranium and plutonium waste solutions originate in the chemical processing buildings or the laboratories, while small quantities are received from other AEC sites. These metal bearing wastes are stored in the following tanks:

Tank No.	Capacity	Location
W-3	40,000-Gallon-Gunite - For Al,Pu,U Wastes	North Farm
W-4	40,000-Gallon-Gunite)	North Farm
W-7	170,000-Gallon-Gunite)	South Farm
W-8	170,000-Gallon-Gunite)- For Pu, U Wastes	South Farm
W-9	170,000-Gallon-Gunite)	South Farm
W-10	170,000-Gallon-Gunite)	South Farm.

When the Tank Farm Area was designed in 1943, only three years' operation of the plutonium pilot plant was expected. The continuing operation of the Laboratory and increased uses of uranium indicated that the storage capacity of the metal waste tanks would be exceeded by 1949. To reduce the volume of the waste to be stored, the uranium and plutonium is precipitated in the Gunite tanks by the addition of fifty-percent caustic soda solution. After a settling period, the supernatant liquor containing about 0.005% U is decanted to the chemical waste system and to White Oak Creek.

3. Miscellaneous Waste Solutions:

The liquid waste solutions received from other AEC installations contain either Source and Fissionable material or radioactive salts. They are disposed of by jetting from the shipping container into the appropriate system in the Tank Farm Area.

NOTE:

Development work is proceeding on a concentration process for the high activity chemical waste solutions. It is expected that an evaporator will soon be installed in the Tank Farm Area to treat about 7,000 gallons of waste/day to reduce the volume by a factor of twenty. This concentrated solution will then be stored rather than disposing of the activities through the Settling Basin to White Oak Creek.

The following reports give more detailed information about the disposal of liquid waste solutions:

1. Increase in Mud Activity from T. H. J. Burnett to W. H. Ray, dated August 5, 1947, Secret, (Discussion of factors-remedies).

2. Activity of Clinch and Emory Rivers (locations and values) from T. H. J. Burnett to W. H. Ray, dated August 11, 1947, Restricted.

3. Water Activity Measurements Near Y-12 (methods and values) from T. H. J. Burnett to Forrest Western, dated January 14, 1948, Restricted, Central Files No. 48-1-173.

4. Activity Values in the Body of a Wildfowl (location and values in tissues) from T. H. J. Burnett to R. H. Firminhac, dated January 15, 1948, Restricted, Central Files No. 48-1-368.

5. Measurement Method for White Oak Dam Discharge Volume (calibration and interpretation) from T. H. J. Burnett to R. H. Firminhac, dated December 1, 1947, Restricted, Central Files No. 47-12-116.

6. Preliminary Report - Efficiency of White Oak Creek (decontamination effected area-wise) from T. H. J. Burnett to R. H. Firminhac, dated November 3, 1947, Restricted, Central Files No. 47-11-554.

7. Water Activity Computations (calculations and variables) from T.H.J. Burnett to E. J. Witkowski, dated January 14, 1948, Restricted, Central Files No. 48-1-175.

WASTE DISPOSAL SYSTEM

[redacted]

SEMI WORKS

-LEGEND-

- V VALVE
- ⊟ DIVERSION BOX
- DRY WELL
- MANHOLE
- JET LINE
- MW METAL WASTE
- BPW BY PRODUCT WASTE
- OF OVERFLOW
- ☆ SAMPLING POINT

ROLLING MILL

101 TRUCK DECONTAMINATION PAD

706-DA

706-A

706-D

FLOOR DRAINS

706-C

2-SINKS
8-CELLS
2-HOODS
1-VAULT

FLOOR DRAINS 2" SS

6" VP

6" VP

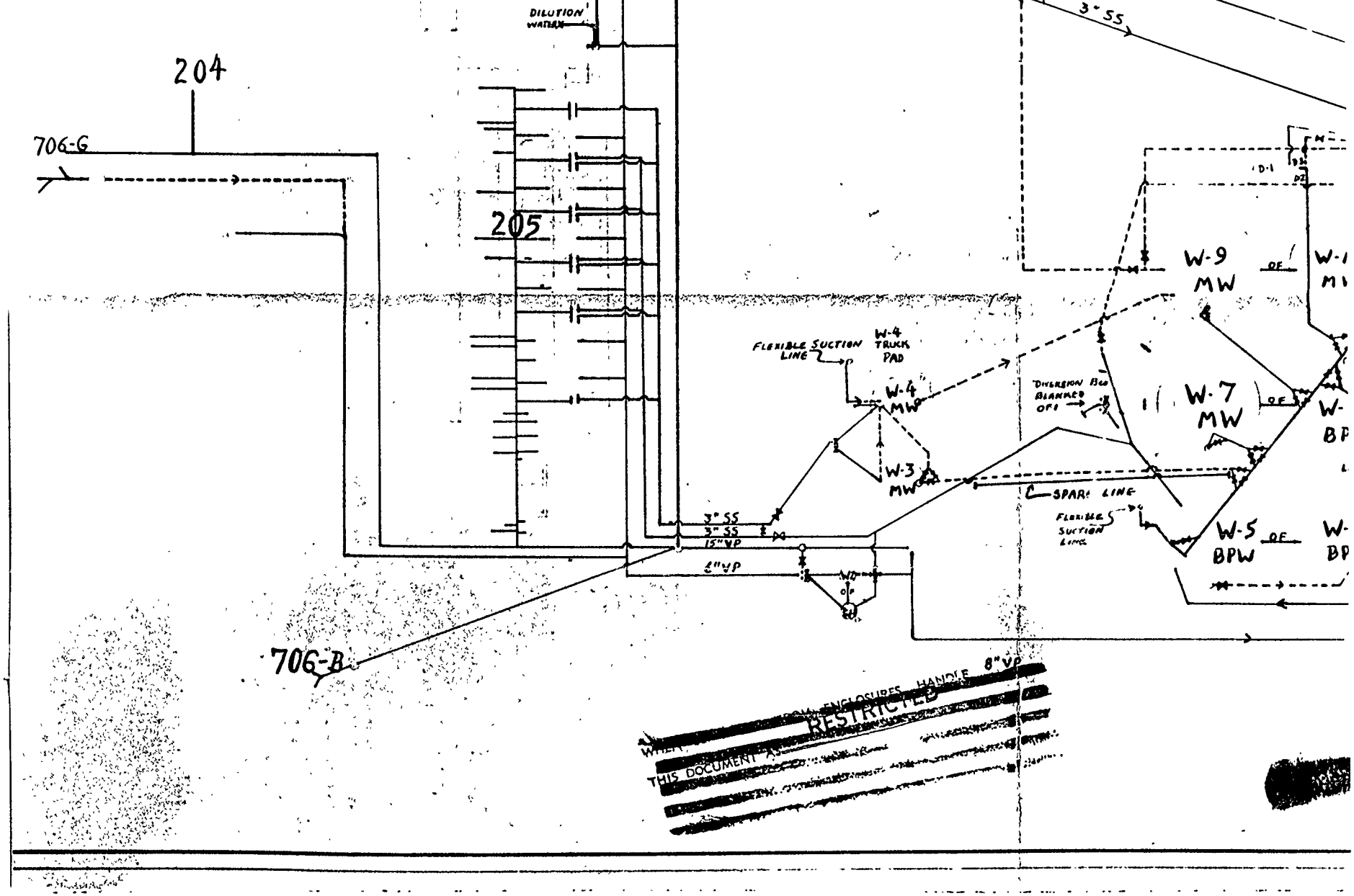
115

105

13

65

78


204
706-G
205
DILUTION WATER
3" SS
W-9 MW
FLEXIBLE SUCTION LINE
W-4 TRUCK PAD
W-4 MW
DIVERSION BD BLANKED OFF
W-7 MW
W-3 MW
SPARE LINE
3" SS
3" SS
15" VP
2" VP
FLEXIBLE SUCTION LINE
W-5 BPW
706-B
8" VP
RESTRICTED
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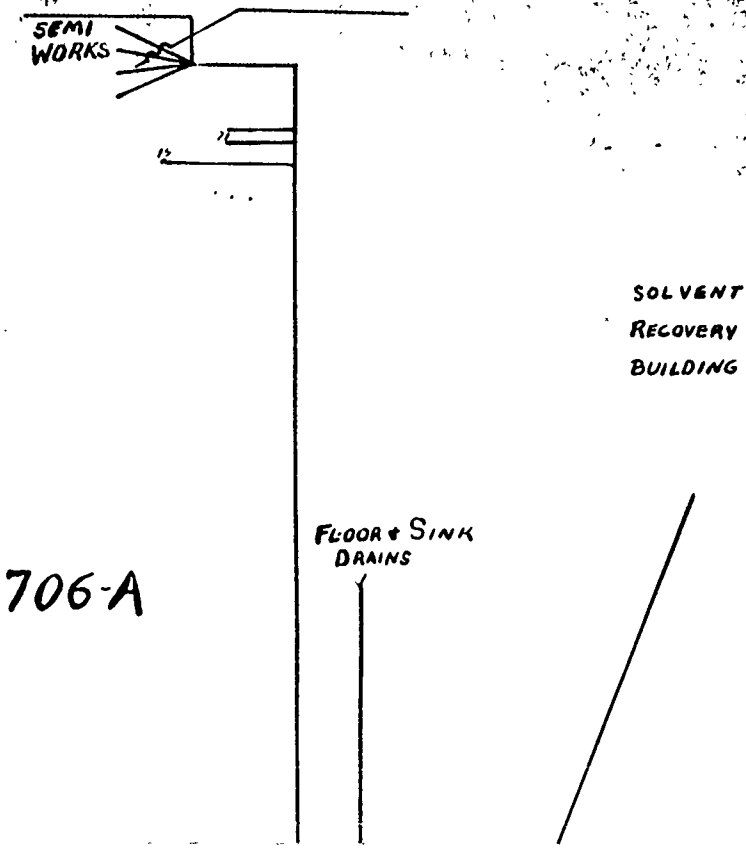


TANK FARM CAPACITIES:

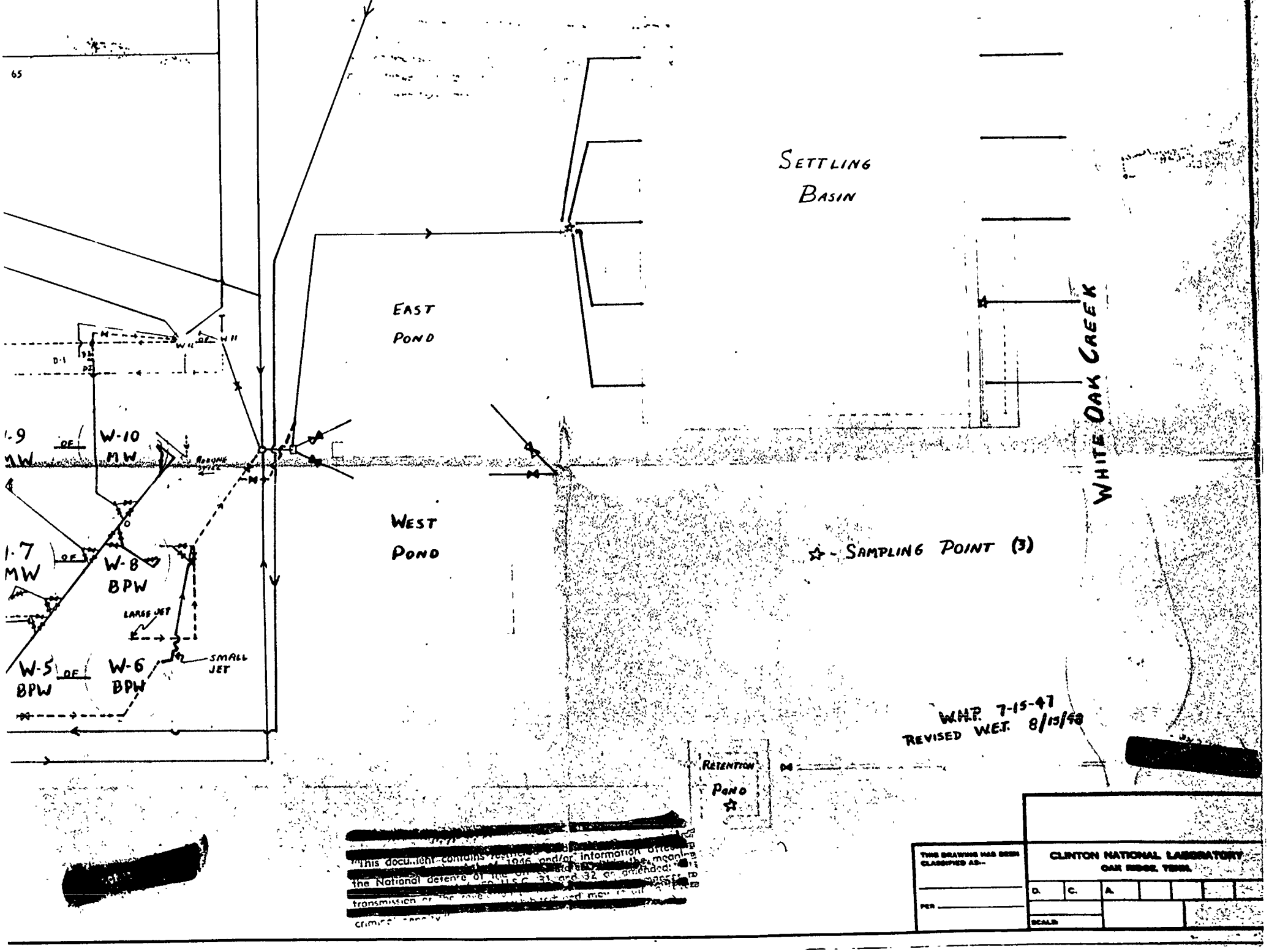
W-1	4400 GALS.	W-9	165,000 GALS.
W-2	4400 "	W-10	170,000 "
W-3	41,300 "	W-11	1,700 "
W-4	41,200 "	W-12	700 "
W-5	170,000 "	E. POND	293,200 "
W-6	170,000 "	W. POND	293,200 "
W-7	166,800 "	RET. POND	32,600 "
W-8	170,000 "	SETTLING BASIN	1,600,000 GALS.

SAMPLING:
ROUTINE SAMPLES ARE TAKEN EVERY FOUR HOURS FROM THE RETENTION POND, SETTLING BASIN OUTLET WIER AND THE SETTLING BASIN DIVERSION BOX.

LEAKS:
ONLY THE DRAINAGE FROM THE DRY WELL SYSTEM GOES INTO THE RETENTION POND, HENCE A HIGH ACTIVITY LEVEL IN THE ROUTINE RETENTION POND SAMPLES INDICATES A LEAK IN ONE OF THE TANKS OR VALVE PITS.

OFF-AREA WASTE DISPOSAL:
IMPORTED SOLUTIONS ARE DISPOSED OF AS FOLLOWS:
① METAL WASTE IS JETTED INTO W-4 THROUGH THE FLEXIBLE SUCTION LINE.
② RADIOACTIVE AQUEOUS WASTES ARE JETTED INTO W-5 THROUGH THE FLEXIBLE SUCTION LINE.
③ HEXONE IS JETTED INTO THE HEXONE STILL AT W-12. DISTILLED HEXONE GOES TO THE DRY WELL; THE RESIDUE IS DRAINED INTO W-10.

Ru^{106} RECOVERY:
Ru^{106} IS RECOVERED FROM THE WASTE IN ANY SUITABLE TANK BY EXTRACTION IN D-3. THE WASTE FROM D-3 GOES TO W-12; Ru^{106} PRODUCT SOLUTIONS ARE DRAWN OFF INTO D-2 AND STORED IN D-1.


65
SETTLING BASIN
EAST POND
WEST POND
WHITE OAK CREEK
☆ - SAMPLING POINT (3)
W-10 MW
W-8 BPW
W-5 BPW
W-6 BPW
LARGE JET
SMALL JET
RETENTION POND
W.H.P. 7-15-47
REVISED W.E.T. 8/19/48
CLINTON NATIONAL LABORATORY
OAK RIDGE, TENN.